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Assessment of the scallop stock in scallop production Area 6, Bay of Fundy for 2001

Évaluation du stock de pétoncle de la zone de production du pétoncle 6 (baie de Fundy) en 2001

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Abstract

An area based management plan was implemented in 1997 for the scallop fishery in the Bay of Fundy. Scallop Production Area (SPA) 6 refers to the waters surrounding Grand Manan Island, Campobello and Deer Islands and vicinity. This area is subdivided into SPA 6B for Grand Manan Island inside zone, 6C for the mainland New Brunswick inside zone, and 6A for the remaining area of SPA 6. These areas are fished by the Mid Bay scallop fleet under a competitive quota system, and by the Full Bay scallop fleet under an Individual Transferable Quota (ITQ) system.

Landings in 2001 were 161 t against a TAC of 155 t. Catch rates increased in 2001 and the Mid Bay fleet CPUE was at it's highest level in the limited (1993-2001) time series. The Full Bay fleet CPUE was above the 1981-2001 median level. Research vessel surveys show little sign of any strong year classes entering the fishery in the next few years. There is a moderate year class showing in the Duck Island Sound area of SPA 6B, but this is a small area and there are concerns over high numbers of clappers observed in this area.

Résumé

Depuis 1997, on applique un plan de gestion par zone à la pêche du pétoncle de la baie de Fundy. La zone de production du pétoncle (ZPP) 6 désigne l'étendue d'eau entourant les îles Grand Manan, Campobello et Deer, ainsi que le secteur avoisinant. Elle est formée de trois sous-zones : ZPP 6B, correspondant à la zone intérieure de l'île Grand Manan, ZPP 6C, la zone intérieure du Nouveau-Brunswick continental, et ZPP 6A, qui couvre tout le reste de la ZPP 6. Ces secteurs sont exploités par la flottille de pétoncliers du milieu de la baie selon un régime de quotas concurrentiel et par la flotille de la baie entière selon un régime de quotas individuels transférables (QIT).

En 2001, les débarquements se sont chiffrés à 161 t, alors que le TAC était de 155 t. En 2001, les taux de capture ont augmenté, et les CPUE de la flottille du milieu de la baie ont atteint le plus haut niveau de la série chronologique qui ne couvre que la période 1993-2001. Les CPUE de la flottille de la baie entière ont dépassé la valeur médiane des années 1981-2001. Selon les relevés de navire de recherche, on ne prévoit pas que de fortes classes d'âge soient recrutées dans les prochaines années. Une classe d'âge d'importance moyenne est présente dans le secteur du passage de l'île Duck (ZPP 6B), mais il s'agit d'un petit secteur, et on s'inquiète du nombre élevé de claquettes qu'on y observe.

Introduction

The first report of scallop fishing in the Bay of Fundy is Perley's "Report on Fisheries in the Bay of Fundy" published in 1851 (cited in Stevenson, 1932). He stated that they were frequently taken in considerable quantities at Mace's Bay, north-west of Point Lepreau, N.B., where extensive beds were known to exist. Scallops first show up in the landings statistics in 1895 when scallops landed between Back Bay and Lepreau, N.B., were canned. Up until 1920 all scallops recorded in the Fisheries Statistics for the Fundy area came from Charlotte County, New Brunswick. Scallop fishing regulations were first introduced in 1918 with licences, a minimum size and closed seasons. These types of regulation are still used for the fishery today. Regulations for specific areas within the Bay of Fundy were first introduced in 1939 with a restriction of gear width specifically for the waters of Grand Manan. The Bay of Fundy scallop fishery became a limited entry fishery in 1972. Over time the scallop fleet still grew as more Bay of Fundy scallop licences were issued, and new licence categories for the inshore New Brunswick and Upper Bay areas were created. In 1986 an accord was reached between the scallop fleets, separating the offshore and Bay of Fundy fleets and creating the Mid Bay line for inshore New Brunswick based vessels. In 1987 an effort to cancel "inactive" inshore licences had limited success.

On January 1, 1997, in response to declining catches and concerns over the long term viability of the fishery, the Bay of Fundy was divided into Scallop Production Areas (SPA's) for better management (Figure 1). Total Allowable Catches (TAC's) were introduced at this time, with sharing formulas to divide the TAC between the scallop fleets for areas where more than one fleet fished.

SPA 6 is fished under two different types of scallop licences. Mid Bay licence holders are permitted to fish from the Mid Bay line to the New Brunswick side of the Bay of Fundy. Full Bay licence holders can fish anywhere in the Bay of Fundy. The Full Bay fleet fishes under Individual Transferable Quotas (ITQ's) while the Mid Bay fleet fishes a competitive quota. The Full Bay fleet has traditionally been Digby based, larger vessels (>14.5 m <19.8 m Length Over All (LOA)) fishing only scallops, and the Mid Bay fleet New Brunswick based, smaller (<14.5 m LOA) vessels with multiple licences for different species. These distinctions are diminishing as and the Mid and Upper Bay fleets become more specialised, and smaller boats are replaced with larger ones.

For management purposes, SPA 6 is subdivided into 6A, 6B and 6C (Figure 1) and management tools include limited entry licences (both fleets), meat counts, minimum shell size,

seasons and gear restrictions (Table 1). There is a special season for an area within SPA 6B known as the Duck Island Sound box (DIS). This has been identified as a highly productive area with large numbers of small scallops, and in the last few years a higher proportion of clappers (paired dead shells) in the catch.

Data used for this analysis come from commercial fishing logs and dockside monitoring documents, port samples of the catch, and independent surveys.

Methods

Data Availability:

Research surveys

There were annual stock assessment surveys of the Grand Manan area from 1979 to 1991. This series resumed with a different survey design in 1996, and now covers all of SPA 6. In the 1996 survey, stations were randomly assigned based on historic fishing effort. The 1997 and 1998 surveys repeated these stations and added others based on current commercial fishing effort.

Survey stations are now randomly assigned to polygons delimiting areas of fishing activity. Polygons are kept from year to year so inter-annual comparisons based on the same areas can be made, and additional polygons are added if there are new areas of fishing activity. The exception to this is five fixed stations in Duck Island Sound (Butler, 1999).

Logbooks

Logbooks have been required for vessels >25.5 gross tonnes (G.T.) since 1973. In 1979 the requirement was changed to vessels > 25.5 G.T. or > 14 m Length Over All (LOA). These requirements covered most of the Full Bay license holders but few of the Mid Bay licenses, although some of these vessels submitted logbooks. In the Full Bay fleet, the percentage of active licenses that submitted logs has varied from 14 to 100%. The Mid Bay license holders agreed to complete logbooks on a voluntary basis in 1996 and logbooks became mandatory in 1997. All vessels are now required to fill out Dockside Monitoring Documents (DMD's), recording information such vessel, date, location, number of tows and average tow time, depth, bottom type and catch. Licence and monitoring document information is used to examine trends in active licences, CPUE's, and fishing distribution patterns.

Port sampling

Port samples have been collected from the Full Bay vessels by DFO since 1983. This was on a voluntary basis up until 2000 when a mandatory port sampling program paid for by

Industry was introduced. There are few port samples from SPA 6 collected from the Full Bay Fleet. The Mid Bay fleet did not have a port sampling program until January 1998 when the Grand Manan's Fisherman's Association initiated a port sampling program for their members. The Campobello Fisherman's Association joined the program in April of 1998, and participation in the port sampling program has increased since then. The information is provided to DFO to monitor the meat sizes being landed. It is also used by both DFO and the fishers to monitor the percentage of small scallops being landed, in an effort to increase future yields by conserving the smaller scallops. The target sampling rate is for 25% of landings from the Mid Bay fleet to be sampled. These samples consist of 2-500 g samples collected from the landings of a vessel. The date, vessel, depth and location where the catch was taken is recorded. The catch muscle is removed and the individual weight of each scallop meat in the sample recorded. Port sampling data is used to look at the distribution of meat sizes in the catch.

Surveys methods

The recent series of research surveys have been carried out in September of each year with the Fisheries Research Vessel J.L. Hart. Tows of approximately 8 minutes duration are carried out at each assigned station with a set of 4 Digby drags (0.762 meters wide, 76 mm rings with rubber washers), 2 lined and 2 unlined. Tow distance is determined using dGPS (differential Global Positioning System) linked to either the Hart's own plotting system or a separate computer. The catch of scallops in the lined (38 mm diagonal mesh liner) drags is used to estimate the catch of scallops <80 mm shell height, and the catch in the unlined buckets is used for scallops □ 80 mm shell height. Catches are standardised to an 800 m tow with a 7 bucket drag (800 m * 5.334 m = 4,267.2 m^2). Trends are examined for mean numbers of scallops per standard tow, and survey shell height frequencies are plotted to examine changes in size distributions.

Results

Surveys

The 2001 survey stations with standardized catches and percent clappers are shown in Figure 2. The highest numbers per tow were found in Duck Island Sound, which also had a high number of clappers in the catch. There was another area with a large number of clappers south of the Wolves Islands.

The flat trends in the survey mean numbers of scallops per standard tow for SPA 6A can be seen in Figure 3. The low numbers of pre-recruits found in this area suggest that catch rates

will not improve in the next few years for this area. The situation in SPA 6B is much better (Figure 4) as a strong year class has entered the fishery and a moderate sized one has shown up in this years survey. The survey trends for the Duck Island Sound box within SPA 6B are shown in Figure 5. This is the area that contains most of the recently recruited year class and the new one appearing in this year's survey. The increase in clappers within Duck Island Sound showing in the last two years surveys can be seen in Figure 6.

The length frequencies from the survey catch do not show any signs of good recruitment in SPA 6A for the next 2 to 3 years (Figure 7). A mode of larger scallops can be seen growing in size and shrinking in numbers from 1998 to 2001. The outlook is better for SPA 6B where a mode of small scallops first seen in 1999 has moved into the fishery, and a smaller mode of 40 mm scallops was picked up in the 2001 survey. SPA 6C has only been covered in the 2000 and 2001 surveys and shows low numbers of larger scallops with little signs of recruitment (Figure 8). The stations in Duck Island Sound contributed most of the small scallops found in SPA 6B (Figure 9). This figure is on a different scale than the others, as the numbers per tow are much higher. A mode of scallops at 95 mm during the 2001 survey is the target of the 2002 fishery, and there is another mode at 40 mm that should enter the fishery in 2004, although it will start to show up in the winter fishery in January of 2003. The increasing numbers of clappers in this area in the last two years is also evident.

Logbooks

The distribution of catch from the logbooks is shown in Figure 10, the effort distribution showed the same spatial pattern. Areas that received a lot of fishing effort were mainly in SPA 6B, although there was another concentration of effort in the Mace's Bay area of SPA 6C. With the exception of the deeper water areas, most of SPA 6 was fished during the year. The catch rate for the Mid Bay fleet has greatly increased over 2001, while effort was down as the fishery shut down when the fleet reached their allowable catch (Table 2). The Full Bay catch rate shows a similar trend (Table 3), although effort was low as the fleet fished elsewhere. The Full Bay fleet did not take their quota in 2001. The CPUE's for both fleets are shown in Figure 11 where the increase in 2001 from the relatively flat trend of the previous six years can be seen.

Port sampling

The port sampling in SPA 6A (Figure 12) shows a wide variation in sizes being fished through the season. The January and February samples indicate fishing on large older scallops, while by April the port samples largely come from a recently recruited year class.

In SPA 6B (Figure 13), the port samples indicate that the fishery was avoiding the small scallops and landing the larger, fully recruited scallops. This is also seen in SPA 6C (Figure 14), although in this area the survey did not show very many small scallops available to the fishery. The Duck Island Sound portion of SPA 6B (Figure 15) shows that the fishery was avoiding the small scallops seen in the survey, and in fact the fishery in this area was closed at industries request when the numbers of small scallops in the catch started to rise.

Discussion

The survey trends in SPA 6A are flat with little sign of recruitment. The port samples from January and February consisted of larger scallops while the April samples consisted mainly of recruiting scallops. In SPA 6B the survey numbers are declining from the peak seen in 2000. In spite of the decline pre-recruit numbers are still well above those seen in SPA 6A. A large proportion of recruits and most of the pre-recruits are located in the Duck Island Sound area. The shell height frequencies show the same trend with low levels of pre-recruits except for Duck Island Sound where the survey picked up a mode of 40 mm scallops that should start recruiting to the fishery in January 2003 and contribute significantly in 2004. The survey stations in SPA 6C showed low numbers of recruited and pre-recruit scallops, although the fishery exploited an area of recruits in Mace's Bay.

The large increase in clapper ratios in the Duck Island Sound area over the last two years (Figure 9) is of concern. Fishers are concerned about both an increased mortality of scallops in this productive area, and the expansion of aquaculture sites reducing the grounds available for fishing. Sampling from a commercial vessel was done in January of 2002 and the length frequencies of live and clapper scallops can be seen in Figure 16, compared to that from unlined buckets from the September survey. The clappers consist mainly of a mode of 80-100 mm shells, smaller than the mode of large scallops picked up in the survey at 95 mm. The shape and position of the mode of clappers indictes that most of them died over a relatively brief time period prior to the September survey. No weak or gaping scallops were seen during the September survey or in January, and live scallops collected during the January sampling and sent to the Atlantic Veterinary Collage in PEI appeared to be healthy. They all showed normal or typical morphologic changes with a normal range of infectious agents. The increase in clappers in this area needs to be investigated so that its cause can be determined.

Conclusion

With little signs of recruitment outside of Duck Island Sound the scallops presently in SPA 6 will have to sustain the fishery through the next few years. The level of removals in 2002 should not be increased for areas outside of Duck Island Sound until there are more signs of recruitment. The cause of the high clapper ratio in the sound should be investigated.

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Stevenson, J.A. 1932. The scallop fishery of the Fundy area. Biol. Bd. Canada, Manuscript Rept. of the Biological Stations. No. 197. 41 pp.

Butler, M.A.E. 1999. Stock status update for SPA 6, Grand Manan and Southwest New Brunswick-1998. Can. Stock Ass. Sec. Res. Doc. 99/60. 28 pp.

Table 1. Management tools used for 2001 in SPA 6. (Done through regulations, conditions of licence and variation orders).

Licencing:
- Limited entry scallop fishing licences

Seasons:
- 6A Fishing from January 1 to December 31
- 6B Fishing from second Tuesday in January to March 31, 6 am to 6 pm Monday to Friday
- 6C Fishing from second Tuesday in January to March 31, 6 am to 6 pm Monday to Friday

Size restrictions:
- Meat count – catch must average no more than 45 meats per 500 g.
- Shell size – No scallops with a shell height less than 95 mm to be retained

Gear restrictions:
- Maximum width of 5.5m
- Minimum ring size of 82 mm inside diameter
- Offshore and sweep drags are not permitted

Reporting requirements:
- Hail out and Hail in
- Dockside monitoring
- Log records
- Port sampling

Additional:
- Special season for Duck Island Sound box within SPA 6B.

Table 2. Historic trends in SPA 6 from Mid Bay logbooks. Class 1 data is logbook records for which all catch, effort and location information is complete. Total effort is in 1000 h, and is estimated from total catch and Class 1 CPUE. The number of Class 1 log records used to estimate the CPUE is "n".

Year	# Vessels	Total Catch(t)	Logged Catch(t)	% Logged	Class 1 Catch(t)	Class 1 Effort	Total Effort	Average CPUE(kg/h)	n	Standard Deviation
1993	3	-	3	0	0	18	-	4.5	2	0.4
1994	7	-	2	0	1	102	-	8.6	11	4.0
1995	7	-	5	0	2	217	-	9.5	26	4.9
1996	62	-	48	0	32	3967	-	8.3	635	4.1
1997	136	95	96	101	85	14657	16084	5.9	2475	3.4
1998	108	142	135	95	123	17900	20509	6.9	2787	3.6
1999	121	125	124	100	113	16809	18366	6.8	2727	3.5
2000	111	131	131	100	120	15264	16542	7.9	2431	4.1
2001	122	145	143	98	129	11590	12839	11.3	1869	7.6

*1992-1996 estimated by prorating total Mid Bay landings by logbook data, accuracy varies with the number of vessels submitting logbooks. 1997 is the first year for which landings were recorded by the new SPA's by Statistics Branch.

Table 3. Historic trends in SPA 6 from Full Bay logbooks. Class 1 data is logbook records for which all catch, effort and location information is complete. Total effort is in 1000 h, and is estimated from total catch and Class 1 CPUE. The number of Class 1 log records used to estimate the CPUE is "n".

Year	# Vessels	Total Catch(t)	Logged Catch(t)	% Logged	Class 1 Catch(t)	Class 1 Effort	Total Effort	Average CPUE(kg/h)	n	Standard Deviation
1981	19	57	44	78	42	1959	2204	25.9	364	24.3
1982	14	27	20	76	19	1360	1590	17.0	224	13.1
1983	10	19	15	80	12	1079	1507	12.6	185	10.3
1984	19	26	23	87	17	1388	2128	12.3	210	8.1
1985	12	20	16	82	12	947	1522	12.9	148	7.7
1986	10	24	12	51	11	975	2041	11.7	125	5.8
1987	-	43	0	0	0	0	-	-	0	-
1988	6	53	5	10	2	98	3455	15.3	20	8.2
1989	10	103	9	9	7	390	5659	18.1	60	12.1
1990	12	110	14	13	9	457	5643	19.4	77	18.2
1991	17	156	35	23	24	1453	9176	17.0	194	8.5
1992	-	75	0	0	0	0	-	-	0	-
1993	8	7	4	49	1	65	351	21.1	9	7.6
1994	1	0	0	0	0	0	-	-	0	-
1995	6	7	4	62	1	160	786	9.1	16	2.0
1996	17	29	14	50	4	360	2303	12.5	51	4.4
1997	45	32	28	88	26	3360	4005	8.1	444	3.6
1998	36	36	33	92	31	3131	3318	10.8	439	7.4
1999	34	25	14	57	14	1552	2617	9.6	229	4.0
2000	12	11	9	85	9	1009	1118	9.7	123	4.4
2001	14	16	15	93	15	873	871	18.6	120	10.9

*1981-1996 estimated by prorating total Full Bay landings by logbook data, accuracy varies with the number of vessels submitting logbooks. 1997 is the first year for which landings were recorded by the new SPA's by Statistics Branch.

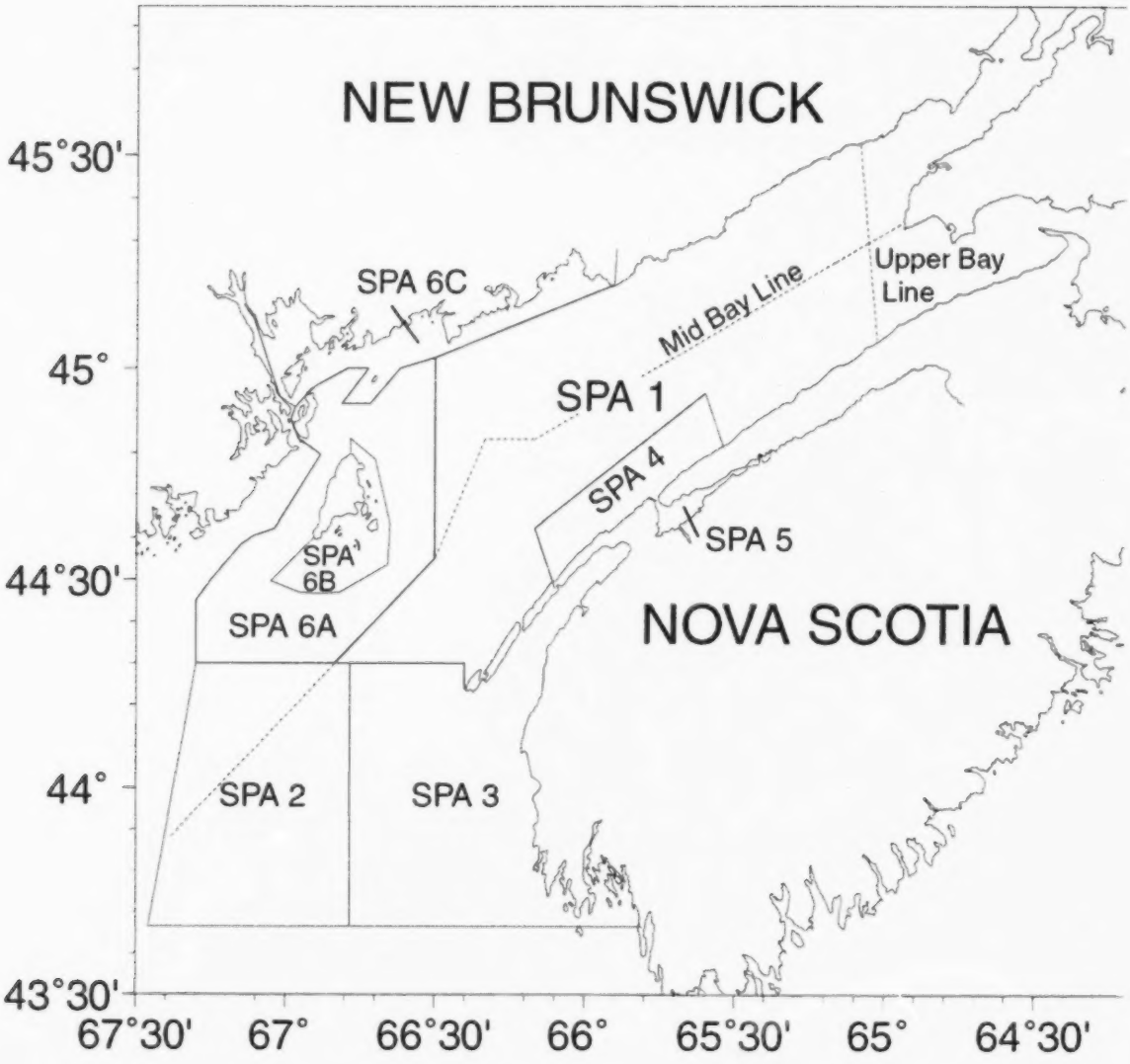

Figure 1. Scallop Production Areas (SPA's) and regulated lines in the Bay of Fundy.

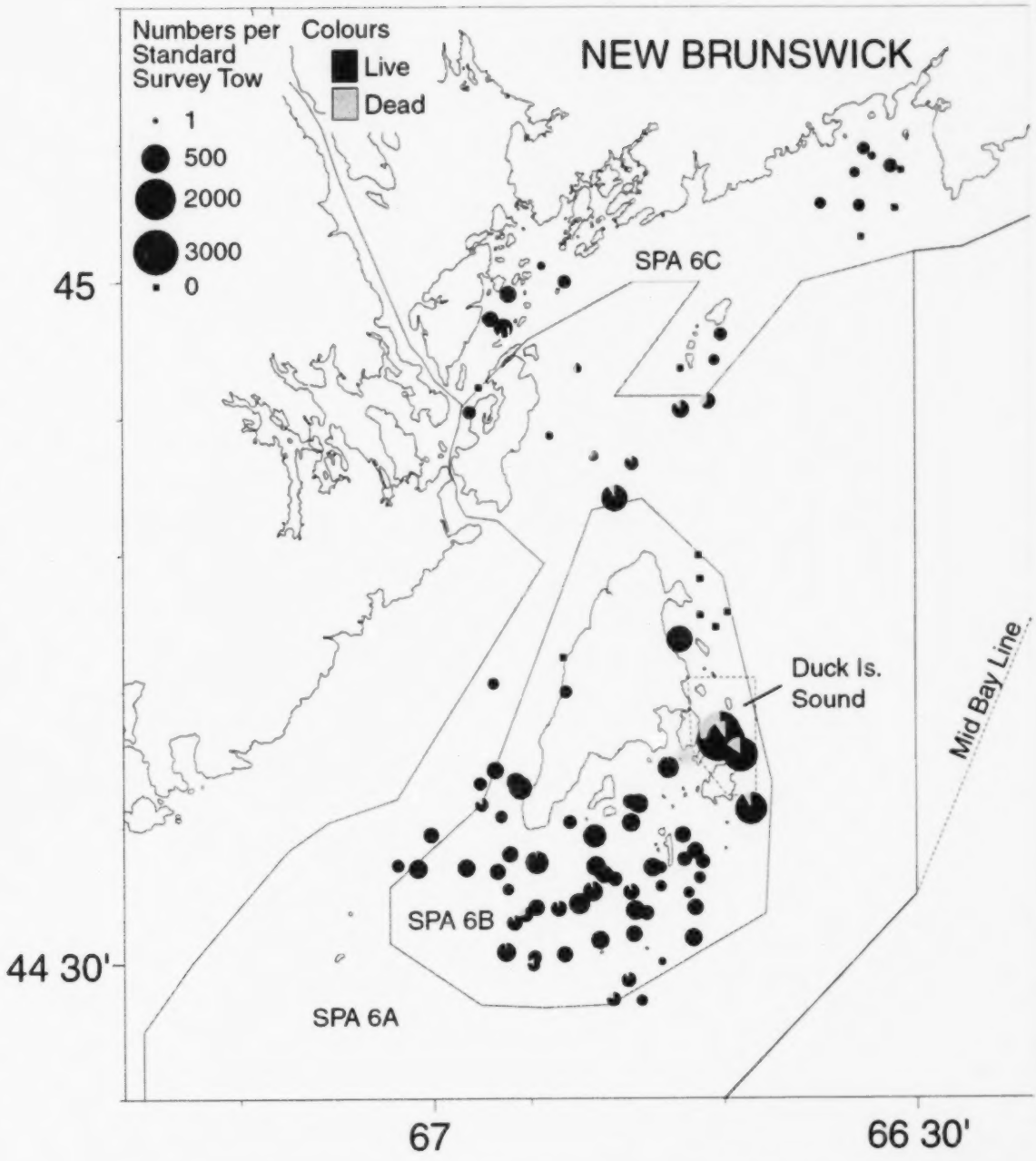

Figure 2. Stations occupied during the 2001 SPA 6 scallop survey. Scaled symbols represent catch in numbers per standard tow, and grey wedges show the percentage of clappers (dead paired shells) in the catch.

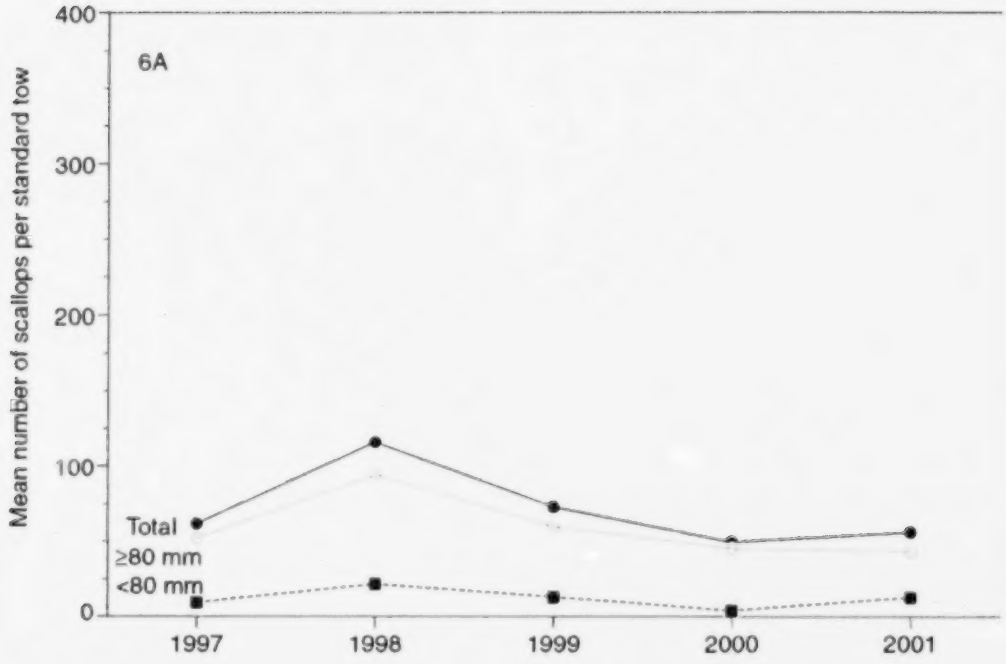

Figure 3. Trends in the survey mean numbers of scallops per standard tow for SPA 6A for pre-recruit(<80 mm shell height), recruited(>=80 mm shell height), and total numbers.

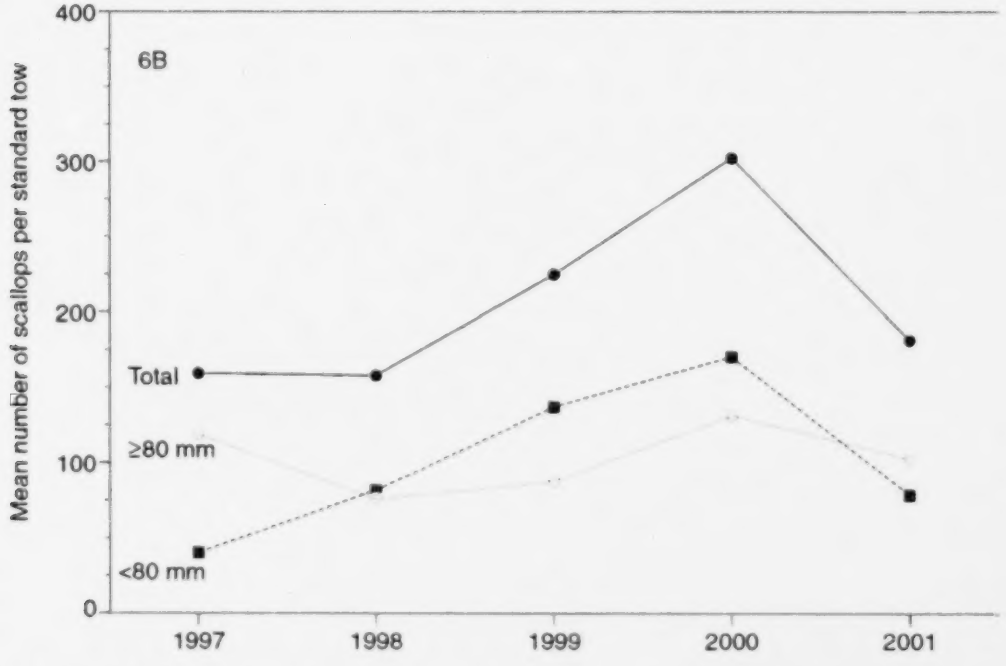

Figure 4. Trends in the survey mean numbers of scallops per standard tow for SPA 6B for pre-recruit(<80 mm shell height), recruited(>=80 mm shell height), and total numbers.

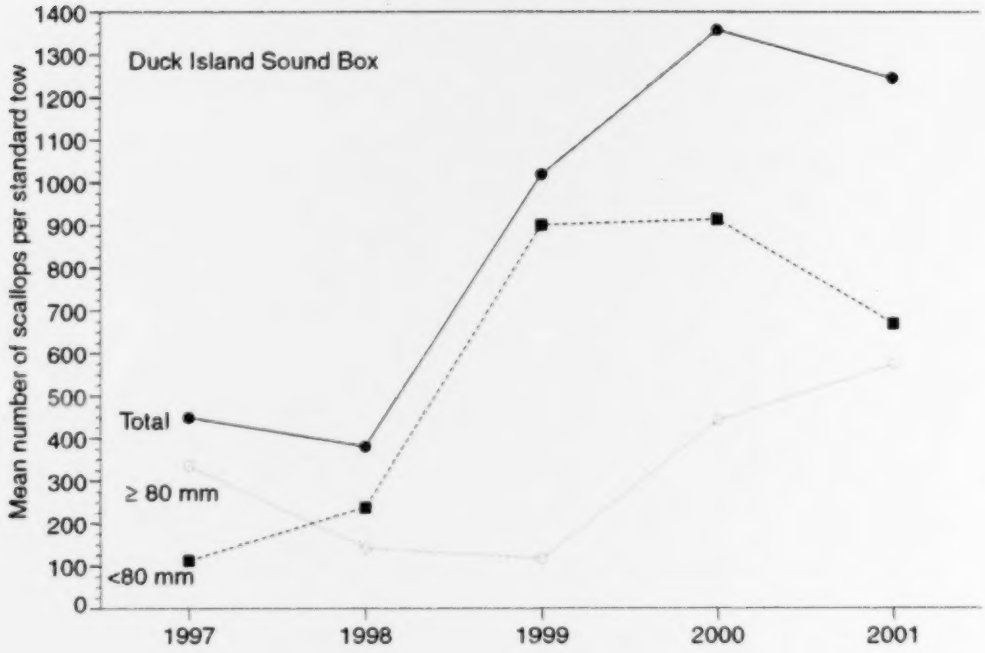

Figure 5. Trends in the survey mean numbers of scallops per standard tow for the Duck Island Sound box in SPA 6B for pre-recruit(<80 mm shell height), recruited(>=80 mm shell height), and total numbers.

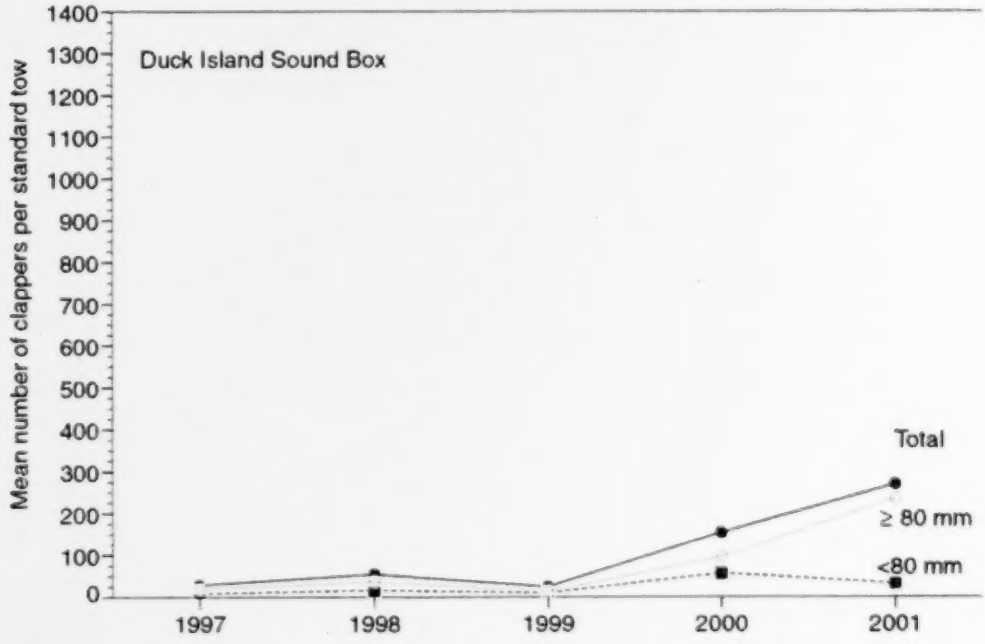

Figure 6. Trends in the survey mean numbers of clappers (paired dead shells) per standard tow for the Duck Island Sound box in SPA 6B for pre-recruit(<80 mm shell height), recruited(>=80 mm shell height), and total numbers.

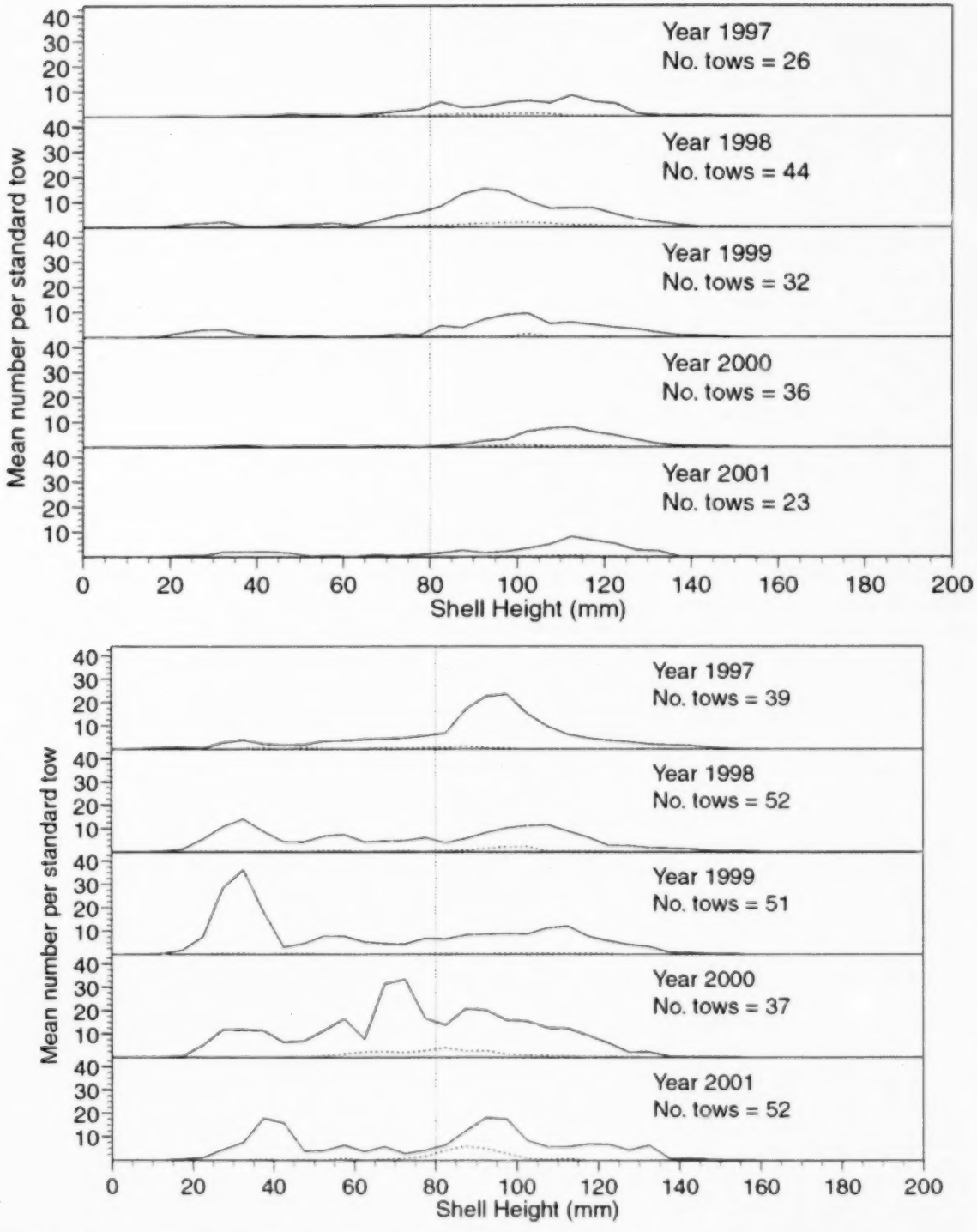

Figure 7. Survey estimates of the mean number of scallops per standard tow at height for SPA's 6A (top)and 6B (bottom) for 1997 to 2001. Solid lines are live scallops, dashed lines are clappers.

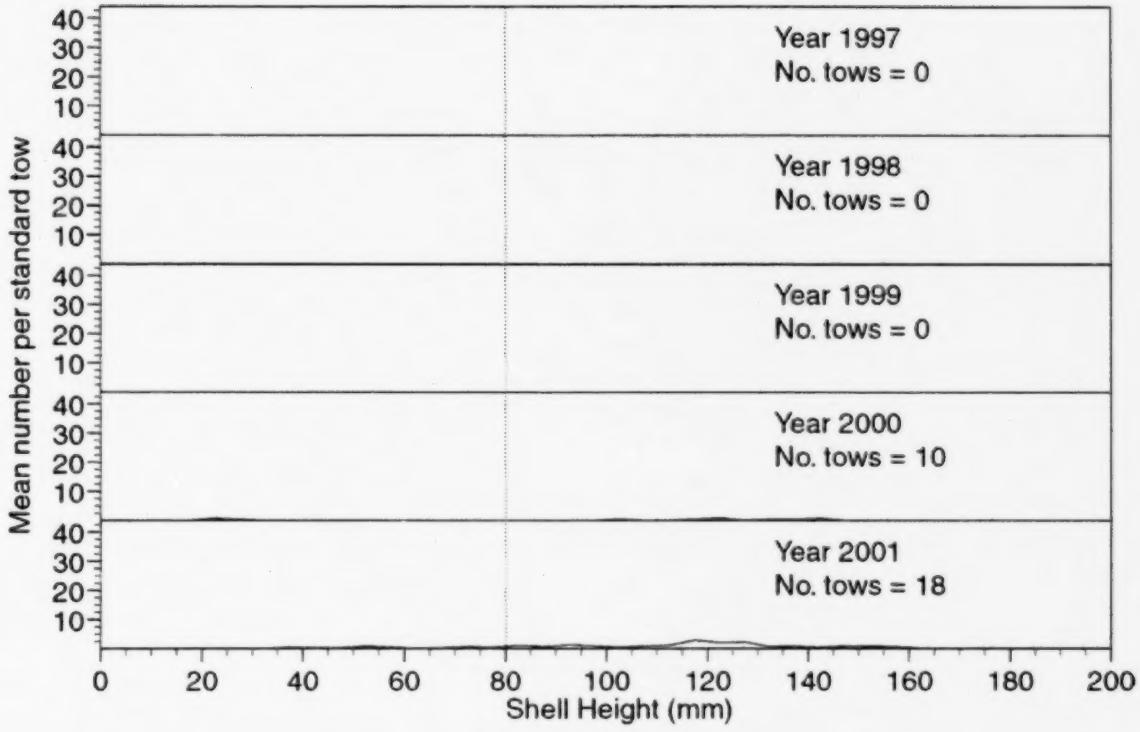

Figure 8. Survey estimates of the mean number of scallops per standard tow at height for SPA 6C. The survey did not cover SPA 6C in 1997 to 1999.

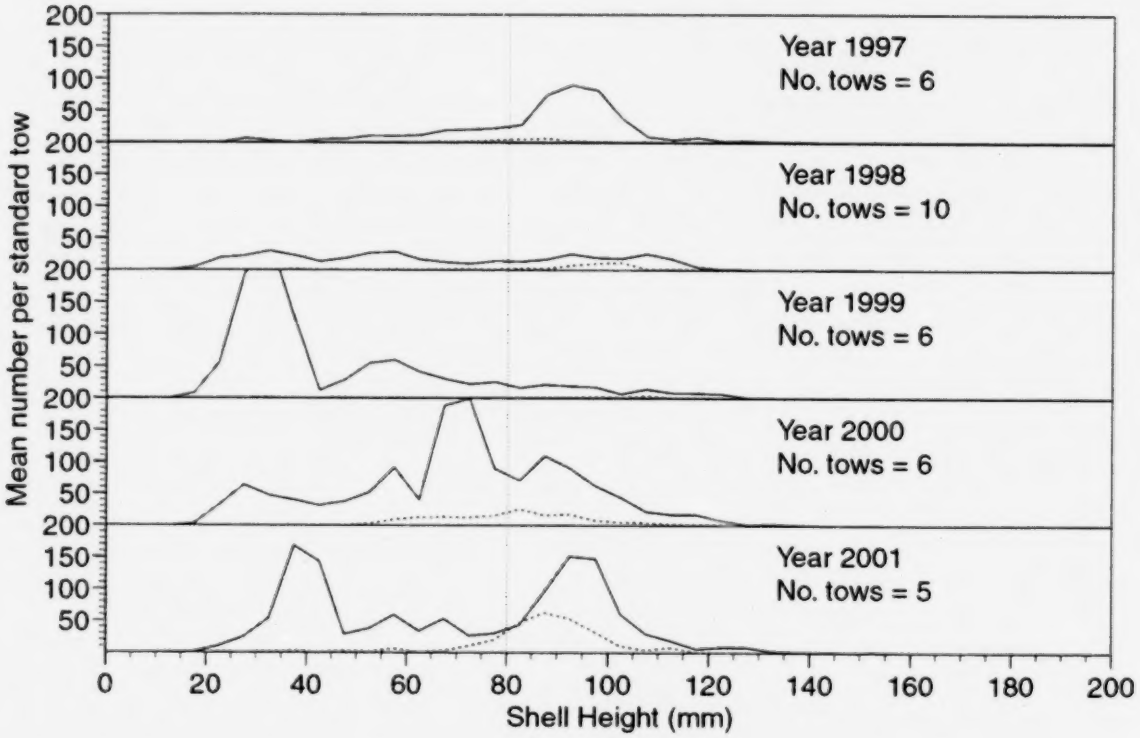

Figure 9. Survey estimates of the mean number of scallops per standard tow at height for the Duck Island Sound Box in SPA 6B for 1997 to 2001. Solid and dotted lines are live scallops, dashed lines are clappers. The scale has been changed from the previous figures.

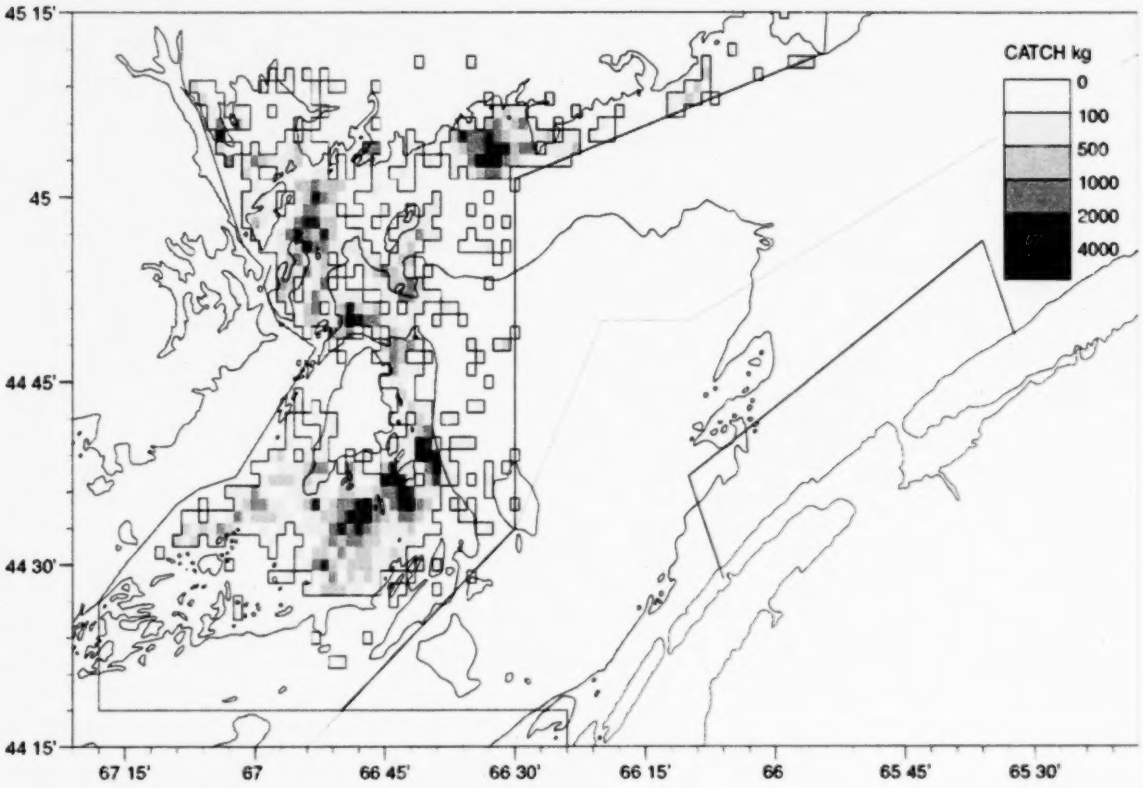

Figure 10. Catch (kg) for 2001 aggregated by one minute squares.

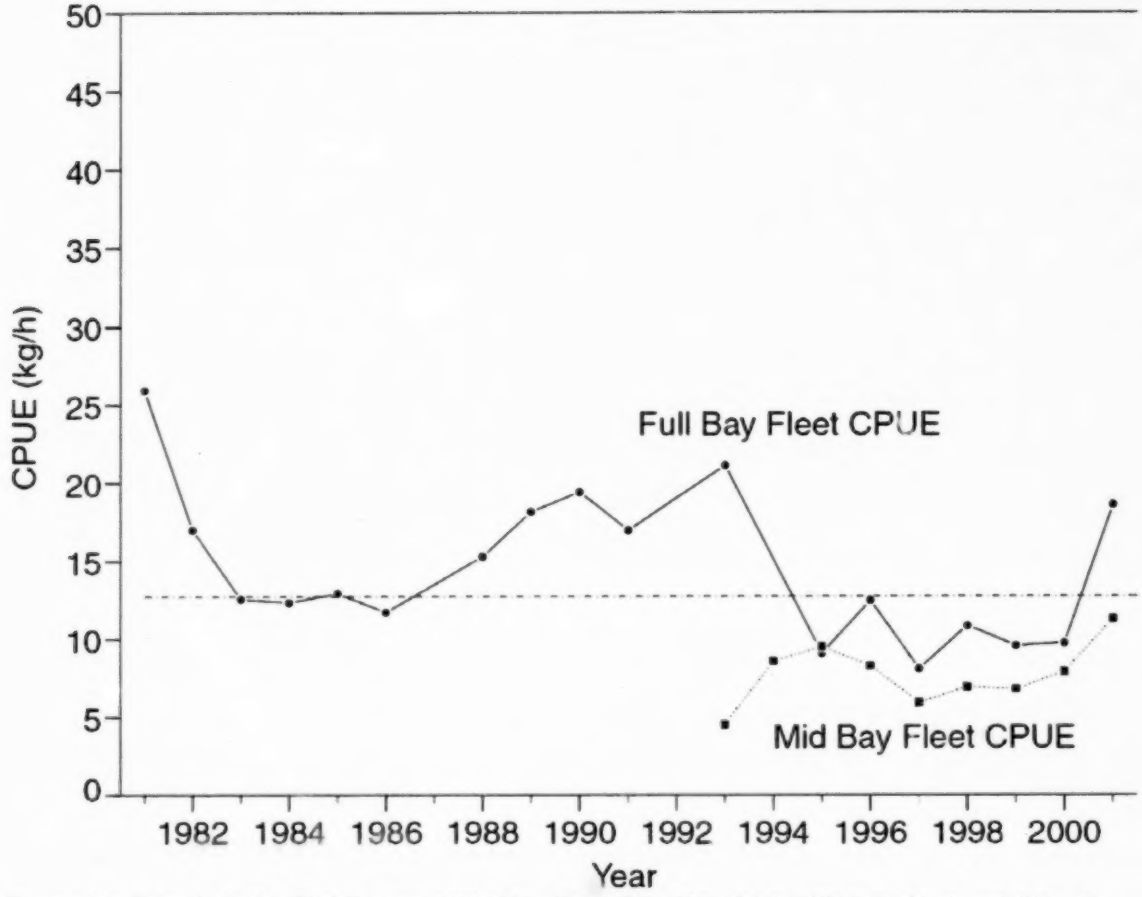

Figure 11. Trends in the Full Bay and Mid Bay Fleet CPUE(kg/h) for SPA 6. Horizontal line is the median CPUE for the Full Bay Fleet from 1981-2001.

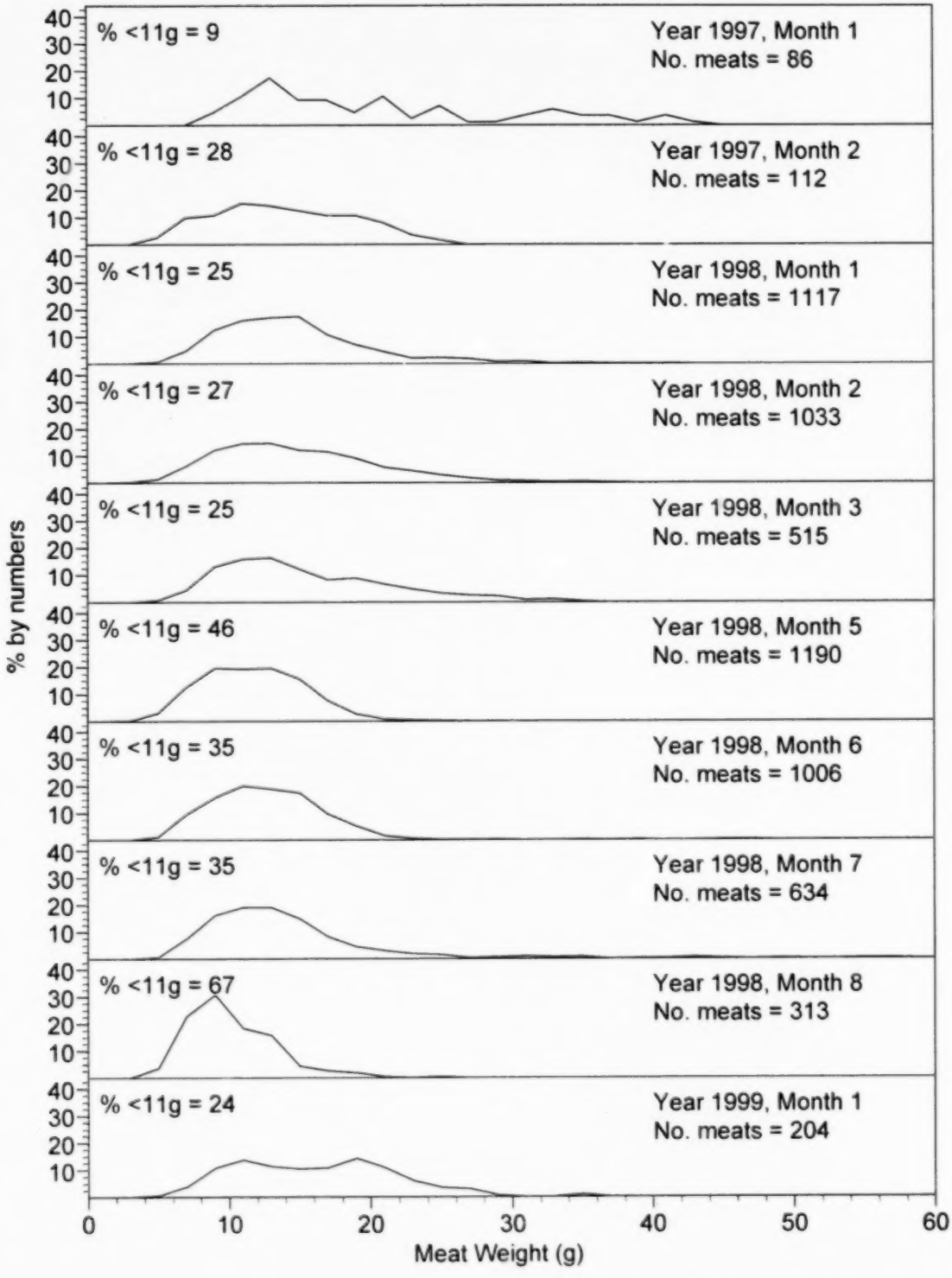

Figure 12a. Meat weight distribution for port samples from vessels fishing in SPA 6A by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

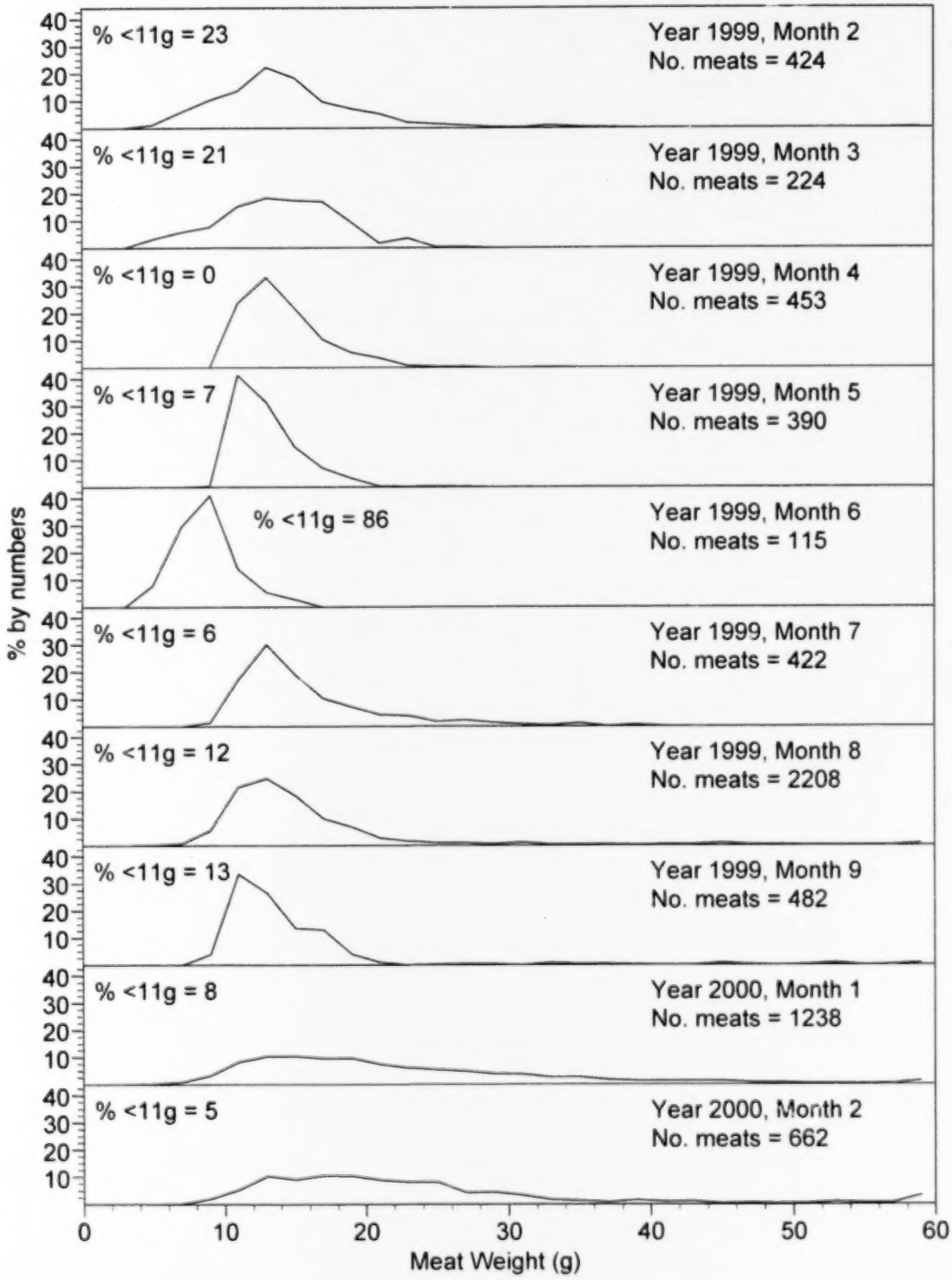

Figure 12b. Meat weight distribution for port samples from vessels fishing in SPA 6A by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

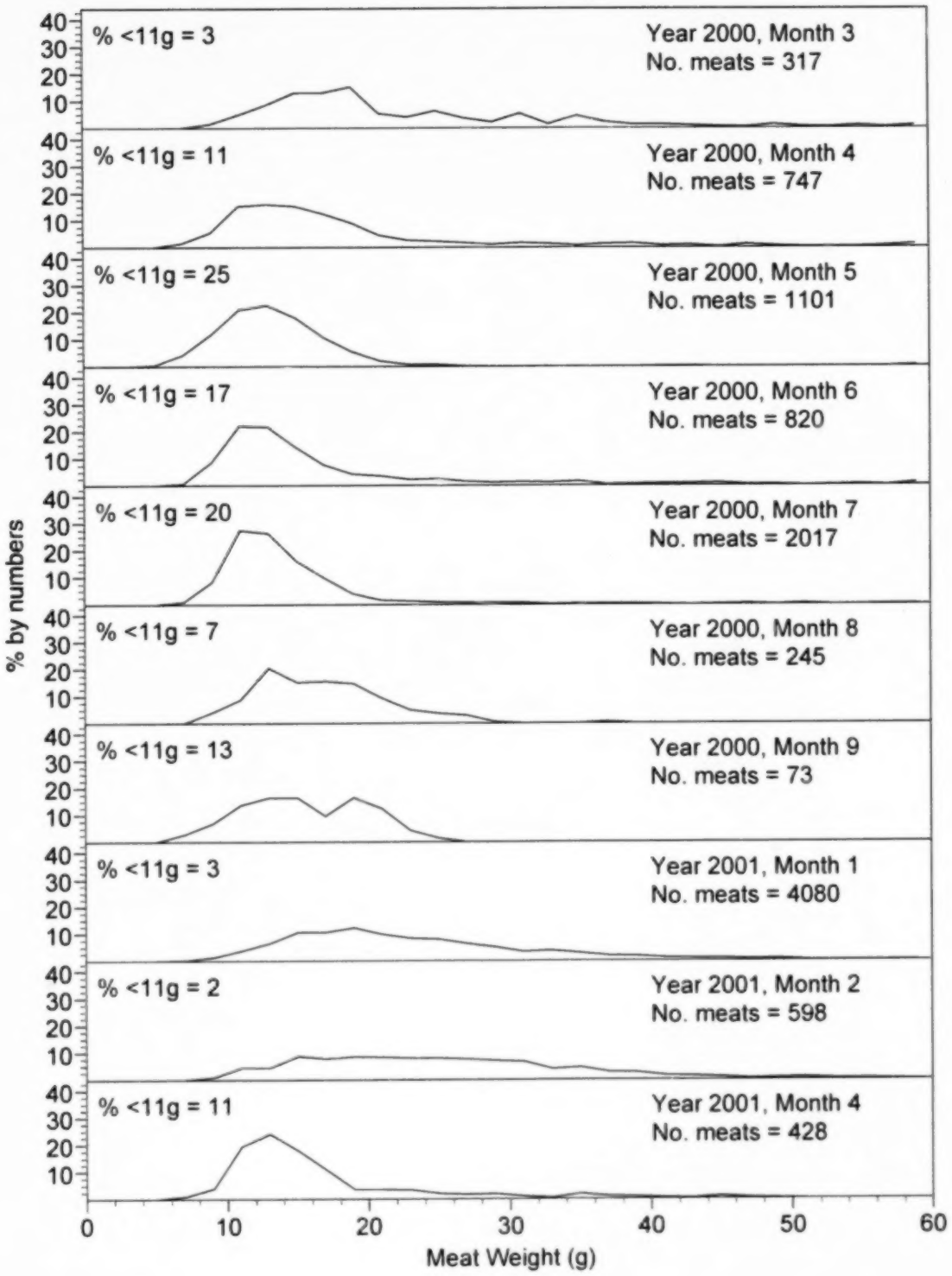

Figure 12c. Meat weight distribution for port samples from vessels fishing in SPA 6A by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

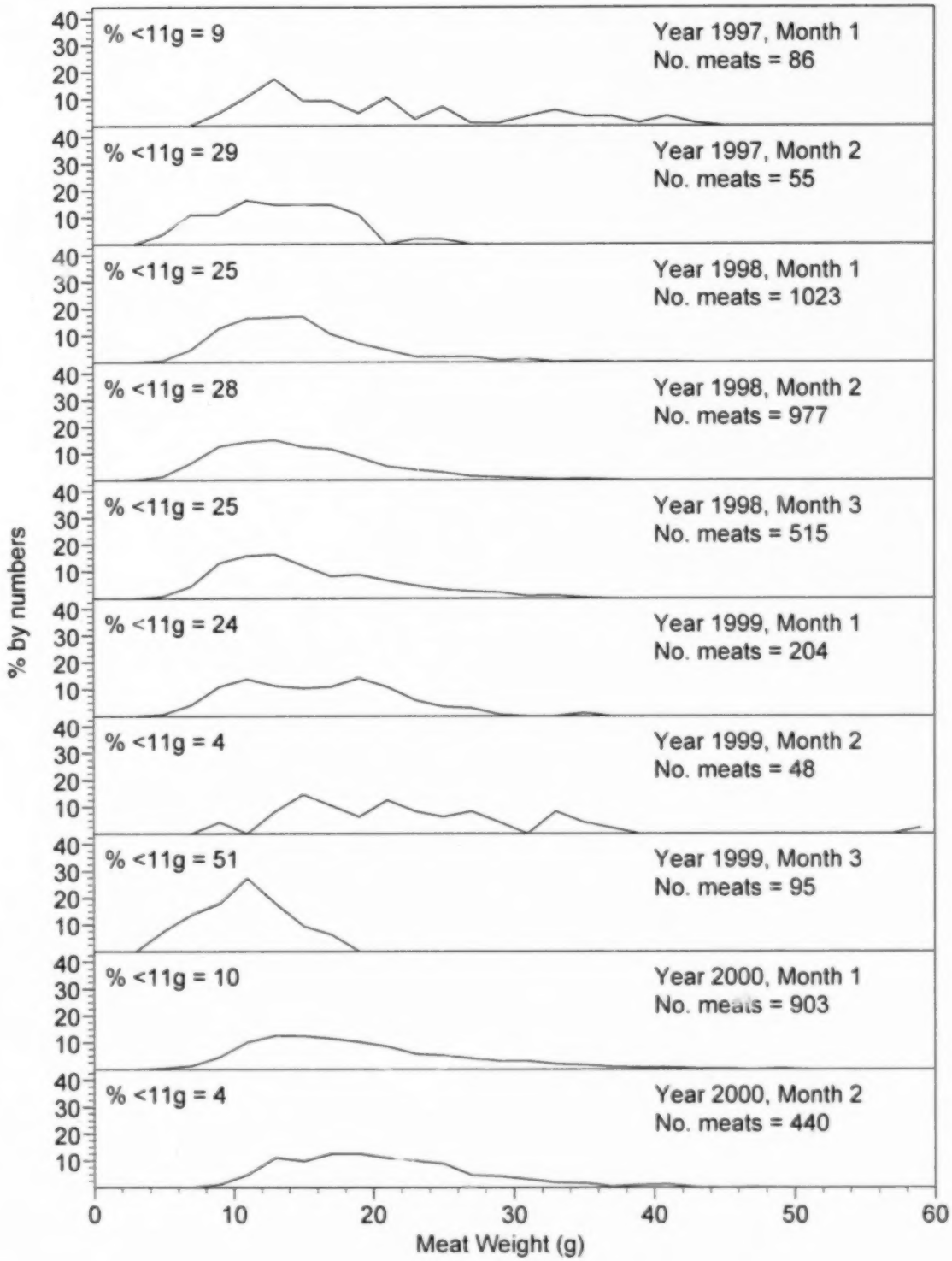

Figure 13a. Meat weight distribution for port samples from vessels fishing in SPA 6B by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

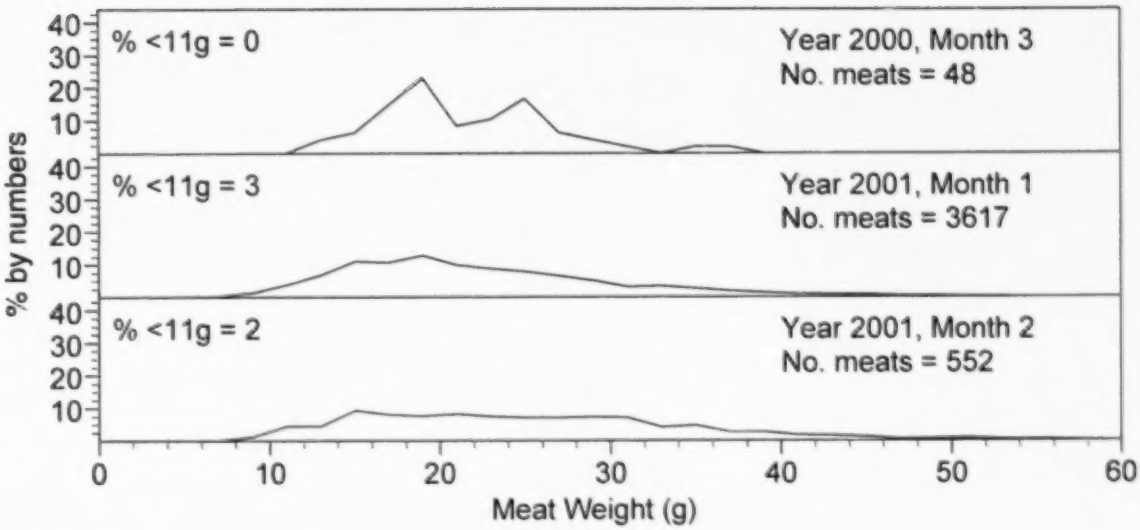

Figure 13b. Meat weight distribution for port samples from vessels fishing in SPA 6B by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

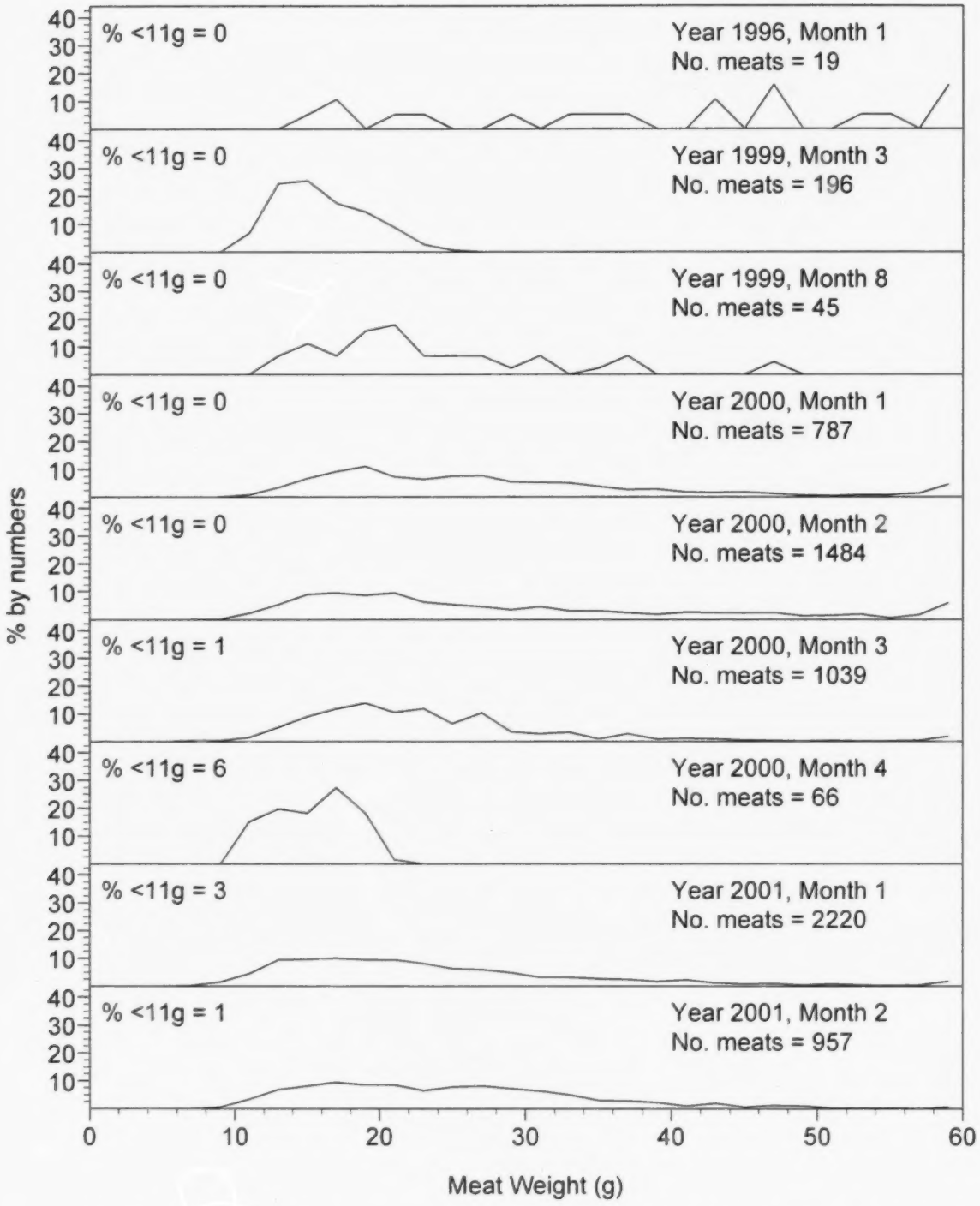

Figure 14. Meat weight distribution for port samples from vessels fishing in SPA 6C by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

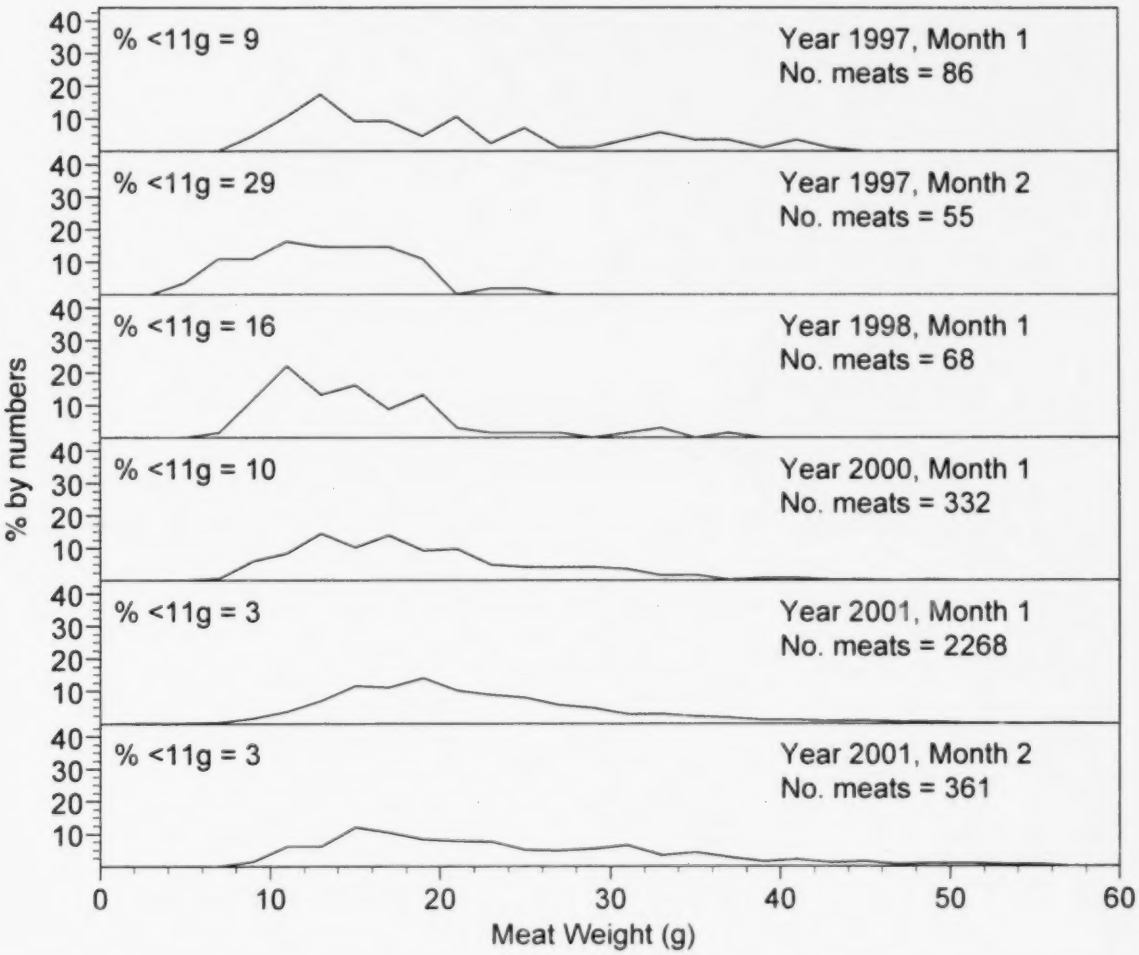

Figure 15. Meat weight distribution for port samples from vessels fishing in the Duck Island Sound portion of SPA 6B by month. Vertical line at 11 grams is the meat weight equivalent to a meat count of 45/500g.

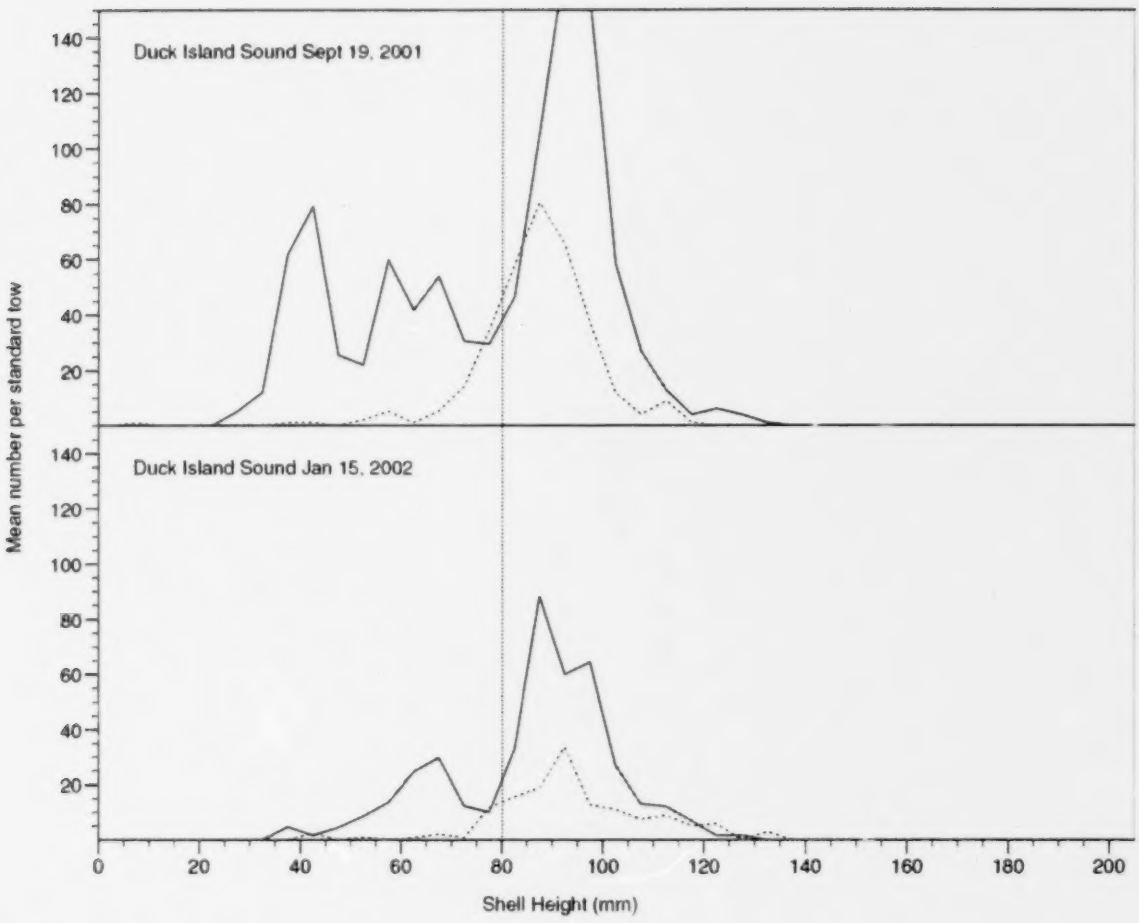

Figure 16. Height frequency samples for unlined gear from the Sept. 19, 2001 survey samples and Jan. 15,2002 commercial sampling in Duck Island sound.